

CLAIMS

What is claimed is:

Claim 1 - A locking ring for holding a liner within an acetabular cup of an artificial hip joint, the acetabular cup having an exterior surface adapted to abut a hip bone and be held securely to the hip bone, the acetabular cup having a generally concave interior surface with an annular groove facing inwardly on said interior surface, and with a pin fixed to the acetabular cup adjacent the groove, the liner having an outside surface adapted to mate within the generally concave interior surface of the acetabular cup and a generally concave inside surface adapted to pivotably support a head of an artificial hip joint coupled to an upper end of a femur, and an annular seat facing outwardly from the outside surface of the liner, the locking ring comprising in combination:

- a top side spaced from a bottom side by a ring thickness that is less than a thickness of the groove of the acetabular cup and less than a thickness of the seat of the liner;

- an outer side spaced from an inner side by a ring width;

- said outer side having an undeformed diameter sufficient to extend at least partially into the groove of the acetabular cup;

- said inner side having an undeformed diameter sufficient to extend at least partially into the seat of the liner;

- said ring width less than a difference between a diameter of the groove of the acetabular cup and a diameter of the seat of the liner;

- a break in said ring, such that enlarging said break expands said outer side diameter and said inner side diameter, and narrowing said break reduces said outer diameter and said inner diameter;

- a captured end adjacent said break and a free end adjacent said break; and

- a slot at said captured end adapted to reside over the pin of the acetabular cup when said ring is located within the groove of the acetabular cup and the seat of the

liner, such that said ring holds the liner within the acetabular cup.

Claim 2 - The locking ring of Claim 1 wherein said slot is longer between an inner end and an outer end than a width of the pin of the acetabular cup, such that the pin can travel within said slot between said inner end and said outer end.

Claim 3 - The locking ring of Claim 2 wherein said slot has a width similar to a width of said pin, such that said pin is restricted essentially to linear motion between said inner end of said slot and said outer end of said slot.

Claim 4 - The locking ring of Claim 2 wherein said slot is angled between said inner end and said outer end with said outer end extending further circumferentially along said ring than said inner end.

Claim 5 - The locking ring of Claim 2 wherein said captured end includes a nob extending beyond said outer side of said locking ring with said slot extending at least partially into said nob.

Claim 6 - The locking ring of Claim 1 wherein said free end includes a finger thereon, said finger extending beyond said outer side of said ring.

Claim 7 - The locking ring of Claim 6 wherein said finger includes at least one graspable curve adapted to be engaged by a grasping device for displacement of the finger and the free end of the ring relative to said captured end of said ring.

Claim 8 - The locking ring of Claim 7 wherein said slot is longer between an inner end and an outer end than a width of the pin of the acetabular cup, such that the pin can travel within said slot between said inner end and said outer end.

Claim 9 - The locking ring of Claim 8 wherein said slot is angled between said inner end and said outer end with said outer end extending further circumferentially along said ring than said inner end.

Claim 10 - The locking ring of Claim 9 wherein said captured end includes a nob extending beyond said outer side of said locking ring with said slot extending at least partially into said nob.

Claim 11 - The locking ring of Claim 10 wherein a beveled surface is provided between said inner side of said locking ring and said bottom side of said locking ring.

Claim 12 - A locking ring for removably holding two concentric structures together with a first structure having an annular groove facing inward and a second structure at least partially inboard of the first structure having an annular seat facing outward, the groove alignable with the seat, the first structure having a pin adjacent the groove, the locking ring comprising in combination:

- a top side spaced from a bottom side by a ring thickness that is less than a thickness of the groove of the first structure and less than a thickness of the seat of the second structure;

- an outer side spaced from an inner side by a ring width;

- said outer side having an undeformed diameter sufficient to extend at least partially into the groove of the first structure;

- said inner side having an undeformed diameter sufficient to extend at least partially into the seat of the second structure;

- said ring width less than a difference between a diameter of the groove of the first structure and a diameter of the seat of the second structure;

- a break in said ring, such that enlarging said break expands said outer side diameter and said inner side diameter, and narrowing said break reduces said outer diameter and said inner diameter;

- a captured end adjacent said break and a free end adjacent said break; and

- a slot at said captured end adapted to reside over the pin of the first structure when said ring is located within the groove of the first structure and the seat of the second structure, such that said ring holds the second structure within the first structure.

Claim 13 - The ring of Claim 12 wherein said slot has a width similar to a width of said pin, such that said pin is restricted essentially to linear motion between said inner end of said slot and said outer end of said slot.

Claim 14 - The ring of Claim 12 wherein said slot is angled between said inner end and said outer end with said outer end extending further circumferentially along said ring than said inner end.

Claim 15 - The ring of Claim 14 wherein said captured end includes a nob extending beyond said outer side of said locking ring with said slot extending at least partially into said nob.

Claim 16 - The ring of Claim 15 wherein said free end includes a finger thereon, said finger extending beyond said outer side of said ring.

Claim 17 - The ring of Claim 16 wherein said finger includes at least one graspable curve adapted to be engaged by a grasping device for displacement of the finger and the free end of the ring relative to said captured end of said ring.

Claim 18 - The ring of Claim 17 wherein a beveled surface is provided between said inner side of said locking ring and said bottom side of said locking ring.

Claim 19 - The ring of Claim 12 wherein said free end includes a finger thereon, said finger extending beyond said outer side of said ring.

Claim 20 - A locking ring, liner and acetabular cup combination for an artificial hip joint, comprising in combination:

- an acetabular cup having an exterior surface adapted to abut a hipbone and be held securely to the hip bone;

- said acetabular cup having a generally concave interior surface;

- said acetabular cup having an annular groove facing inward from said generally concave interior surface;

- a liner having an outside surface adapted to mate within said generally concave interior surface of said acetabular cup;

- said liner having a generally concave inside surface adapted to pivotably support a head of an artificial hip joint coupled to an upper end of a femur;

said liner having an annular seat facing outward from said outside surface of said liner;

a locking ring having a top side spaced from a bottom side by a ring thickness that is less than a thickness of said groove of said acetabular cup and less than a thickness of said seat of said liner;

an outer side spaced from an inner side by a ring width;

said outer side having an undeformed diameter sufficient to extend at least partially into said groove of said acetabular cup;

said inner side having an undeformed diameter sufficient to extend at least partially into said seat of said liner;

said ring width less than a difference between a diameter of said groove of said acetabular cup and a diameter of said seat of said liner;

a break in said ring, such that enlarging said break expands said outer side diameter and said inner side diameter, and narrowing said break reduces said outer diameter and said inner diameter; and

a captured end adjacent said break and a free end adjacent said break.

Claim 21 - The combination of Claim 20 wherein said acetabular cup includes a pin affixed thereto adjacent said groove, and wherein a slot is provided at said captured end adapted to reside over said pin of said acetabular cup when said ring is located within said groove of said acetabular cup and within said seat of said liner, such that said ring holds said liner within said acetabular cup.

Claim 22 - The combination of Claim 21 wherein said slot is angled between said inner end and said outer end with said outer end extending further circumferentially along said ring than said inner end.

Claim 23 - The combination of Claim 22 wherein said captured end includes a nob extending beyond said outer side of said locking ring with said slot extending at least partially into said nob.

Claim 24 - The combination of Claim 22 wherein said free end includes a finger thereon, said finger extending beyond said outer side of said ring.

Claim 25 - The combination of Claim 20 wherein said combination includes a deforming seal interposed between said outside surface of said liner and said interior surface of said acetabular cup, said deforming seal located adjacent a top bore extending between said interior surface of said acetabular cup and said exterior surface of said acetabular cup, said deforming seal adapted to be deformed when said ring is located within both said groove of said acetabular cup and said seat of said liner.

Claim 26 - The combination of Claim 25 wherein said deforming seal is attached to said outside surface of said liner.

Claim 27 - The combination of Claim 26 wherein said deforming seal includes a circular edge sized to abut said interior surface of said acetabular cup surrounding said top bore.

Claim 28 - The combination of Claim 27 wherein said circular edge of said deformable seal defines a largest diameter edge of a cone formed of a material similar to a material from which other portions of said liner are formed and with sufficient thickness between an outer conical surface and an inner conical surface of said cone to allow said edge to be deflected toward said outside surface of said liner, when said locking ring resides within said groove of said acetabular cup and said seat of said liner with said edge of said cone abutting said interior surface of said acetabular cup surrounding said top bore.

Claim 29 - A locking ring for holding a liner within an acetabular cup of an artificial hip joint, the acetabular cup having an exterior surface adapted to abut a hip bone and be held securely to the hip bone, the acetabular cup having a generally concave interior surface with an annular groove facing inwardly on said interior surface, the liner having an outside surface adapted to mate within the generally concave interior surface of the acetabular cup and a generally concave inside surface adapted to pivotably support a

head of an artificial hip joint coupled to an upper end of a femur, and an annular seat facing outwardly from the outside surface of the liner, the locking ring comprising in combination:

- a top side spaced from a bottom side by a ring thickness that is less than a thickness of the groove of the acetabular cup and less than a thickness of the seat of the liner;

- an outer side spaced from an inner side by a ring width;

- said outer side having an undeformed diameter sufficient to extend at least partially into the groove of the acetabular cup;

- said inner side having an undeformed diameter sufficient to extend at least partially into the seat of the liner;

- said ring width less than a difference between the diameter of the groove of the acetabular cup and the diameter of the seat of the liner;

- a break in said ring, such that enlarging said break expands said outer side diameter and said inner side diameter, and narrowing said break reduces said outer diameter and said inner diameter; and

- a captured end adjacent said break and a free end adjacent said break.

Claim 30 - The locking ring of Claim 29 wherein said captured end includes a means to slidably hold said captured end to the acetabular cup.

Claim 31 - The locking ring of Claim 30 wherein said slidable holding means includes a pin fixed to the acetabular cup adjacent the groove and a slot adjacent said captured end of said locking ring, said slot adapted to reside over the pin of the acetabular cup.

Claim 32 - The locking ring of Claim 31 wherein said slot is angled between an inner end and an outer end with said outer end extending further circumferentially along said ring than said inner end.

Claim 33 - The locking ring of Claim 31 wherein said slot has a width similar to a width of the pin, such that the pin is restricted essentially to linear motion between said inner end of said slot and said outer end of said slot.

Claim 34 - The locking ring of Claim 31 wherein said captured end includes a nob extending beyond said outer side of said locking ring with said slot extending at least partially into said nob.

Claim 35 - The locking ring of Claim 30 wherein said free end includes a means to grasp said locking ring.

Claim 36 - The locking ring of Claim 35 wherein said grasping means includes a finger extending beyond said outer side of said locking ring.

Claim 37 - The locking ring of Claim 36 wherein said finger includes at least one graspable curve on said finger.